

Radicals '09



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From the Principal's Desk

Nature provides us with the best laboratory. The science of Chemistry seeks to unravel the mysteries of nature, and has in recent years revolutionised the world. This issue of Radicals '09 delves into this fascinating world of discovery which makes us marvel at the complexity and immensity of creation.

This magazine aims to promote and kindle the interest and enthusiasm of the youth for the study of pure sciences. No doubt, it will serve as a platform for young minds to give creative expression to their knowledge.

"Tell me how you acquired your scientific knowledge." To this query, Dr. Walter Russell gave the following insightful reply: "It is because I always look for the cause behind things and don't fritter away my time analyzing effects." Indeed, an inspiring thought to aspiring and creative youth anywhere in the world.

My sincere congratulations to the faculty and students of the Department of Chemistry in this endeavour to make thousands, nay, millions think. I look forward to the early publication of 'Radicals '09'

Dr. Sr. Jasintha Quadras, fmm
Principal

Preface

CHEMISTRY? OOPS! No, never! With the lab work, risky chemicals, irritating odours, messy lab coats, glass apparatus to be handled, breakages.....My Good Lord, No! Never! Wait Wait! Hold ON! Read This...

Ernest Davidson, a distinguished Professor and a member of the National Academy of Sciences and the American Academy of Arts and Sciences has a desk, some books--and a computer instead of beakers - HE IS A CHEMIST, as against the definition of Chemists!

Recent changes in information technology have altered the parameters of what goes on in a chemistry laboratory as well. Perhaps commercially available software can calculate spectra, molecular structure, and reaction paths in one laboratory that is the Internet itself. The net has allowed for a boom in collaborative efforts, which have the potential for making headway into the secrets of chemistry faster and more effective than the most gifted lone researcher can, without any need for travel, letter writing, or even phone calls. Immediate net access to any team member's results is now possible around the globe; people separated by a continent or more can routinely consult the same up-to-the-minute graphs, altering their theories as new data comes in. Joint collaboration around the world is the real information technology revolution.

There are always problems to be solved in chemistry from beakerless laboratory, where nothing bubbles, nothing irritates the nostrils! The problems we address at any given time are the ones our computers can handle. It is clear that as the supercomputing age progresses, not just the quantum chemists, even the experimental chemists are and will be simulating the experiments on computers!

Computers have definitely changed the quality of publishing to elegant and a pleasure!! The first ever magazine that was brought out in the early eighties, was hand written and typed. Taking copies was much more difficult. "Publish or perish" is the norm of today's world and here we are, publishing the seventh edition of "Radicals", an annual departmental magazine, which gives space to dreams and visions of students and teachers to be expressed!

Have fun with Radicals and Chemistry!

The hope and dream of the Department is that this magazine, in due course, should also be able to publish research articles and reviews at the standard of Journals.

I take this opportunity to congratulate the editorial team with the leadership and guidance of Ms. Mary George and Dr. Shyamala K, who have made this issue possible!

Dr.Rukmani Srinivasan
Head PG. Dept of Chemistry

From The Editorial Board

"Wake up, girls, wake up! What about our chemistry magazine? Where are the articles? Where is the creativity?" These were the questions that pounded against our ears everyday upon entering college. Though we were lazy, inert & inactive at the beginning, as "Reactions" progresses, what we came to experience was a complete amalgamation of thoughts, creativity & fun!

Running around for sponsors, hunting for sponsors, shouting at juniors, getting fed up with editing – Indeed, everyday was hectic. But at the end of the day, we are now at the peaks of happiness, satisfaction & relief. We would like to acknowledge all the effort and the guidance that was given by the staff of our department, especially our driving forces – our faculty advisors Ms. Mary George & Dr. Shyamala K, and of course, our fellow students. It is with immense pride that we finally present you

with

Radicals '09!

ORIENTATION PROGRAMME FOR THE NEWLY RECRUITED GOVERNMENT COLLEGE LECTURERS

Dr. Rukmani Srinivasan,
Head, PG. Dept of Chemistry.

The Department of Chemistry, Stella Maris College was bestowed with the opportunity of organizing the twenty four days Orientation Programme for the Newly Recruited Government College Lecturers from 13.10.08 to 8.11.08, by TANSCHÉ. This indeed was an opportunity to serve the teacher fraternity. " catch them fresh" could be the proverb which perhaps has driven TANSCHÉ to conduct such a program for the newly recruited Lecturers who are fresh and excited with the new appointment, malleable and ready to absorb the inputs that were given to them. Therefore it was a very laudable effort by TANSCHÉ, Academic Staff College and the Government of Tamil Nadu!

The Nodal Officer was Dr. Rukmani Srinivasan, Head, Dept. of Chemistry and Dr. Shiny John Vairamon, Faculty, Dept. of Chemistry was the coordinator of the Program. The Programme commenced on 13.10.08 (FN) and inaugurated by Dr. Sr. Jasintha Quadras, Principal of Stella Maris College and the inaugural message was given by Dr. Sr. Helen Vincent, fmm. 88 technical sessions were incorporated and each session was about 1.5 hours.

The Course Schedule focused on six most needed sectors as follows: Teaching Methodology, Chemistry, Life skills, Communication skills, Higher Education, Human rights.

Chemistry section covered 16 interesting fields with experts in the respective fields. Liquid Crystal and Solid State, Stereochemistry, Polymer Chemistry, Analytical Techniques Spectroscopy, Biomaterials and its applications, Computational Chemistry and a visit to CLRI to see the thermal and spectroscopic Instruments.

Life Skills training comprised of 16 different aspects like Adolescent Health and Behaviour, Yoga practice, Guidance and counseling, Teaching and Administration, Team Building, Self Analysis, Building Achievement habits, Building leadership and Human Relations. Fourteen divergent units were blended in Communication

skills

Effective Communication, Oral and Written Skills, Vocabulary, Phonetics, Sentence making, Reading skills and the Reading and Listening skills.

Topics on Higher Education were distributed into four broad areas: Curriculum Development and Designing, Contemporary issues in Higher education, Quality in Higher Education and National policy on education. Human Rights was no exception which consisted two significant elements. Human rights and duties and Gender and Value Education .

The flying squad visit by the TANSCHÉ office bearers, by the DCE, AD and others helped the organisers to be alert and indicated to the participants the seriousness of the program.

There was also an open and informal feed back from the participants then and there on the effectiveness of the program.

"On the whole, the course was

- Extremely well planned
- Each and every hour had healthy discussions
- Sequentially arranged and subject matter flowed well through the different sessions

The participants commented that this orientation programme provided them a forum for gathering innovative ideas and techniques. We extend our gratefulness to the prominent personalities of this show, Dr.Rukmani Srinivasan, Nodal Officer and Dr. Shiny John Vairamon Coordinator, Stella Maris College", reported one of the participants, Dr.S.Kannan, Lecturer in Chemistry,L. N. Government Arts College, Ponneri, Chennai., at the valedictory function at the University of Madras, in the presence of the Education Minister.

The program organised gave the Nodal officers and the coordinators, immense satisfaction, new contacts and new experiences. The feed back was very heart warming and to know that the entire group appreciated the effort taken by us to arrange a quality program and the insistence on punctuality and discipline as teachers has borne fruit. The long sustained effort at the conduct of the program amidst heavy rains and Diwali acting as speed breakers did bear fruit!

Dr. Sr . Annamma Philip, fmm., Research Lab

Dr.Rukmani Srinivasan
Head PG. Dept of Chemistry

The department of Chemistry was proud to inaugurate Dr. Sr . Annamma Philip, fmm., Research Laboratory on 17th July 2008 with a prayer and blessing by Fr.P.George and with the lamp 'lighted to lighten' by the Dr. Sr. Jasintha Quadras, fmm, Principal of the college, Sr. Susan, fmm., superior of the convent and office incharge and, Dr. Rukmani Srinivasan, Head ,Dept of Chemistry and Ms. Uma , student , I M.Sc Chemistry and Fr.P.George.

Dr. Sr . Annamma Philip, fmm., the Head of the Department and Principal of the college for a long number of years, had several dreams for the growth and development of the Institution and the Department. As she fulfilled many such dreams, many more cropped up and one such was a research wing. Dr. Sr . Annamma Philip, fmm., Research Fund of Rs. 400,000/- was instituted on her retirement from the funds contributed by the alumnae and friends of the Department. The half yearly interest from the fund is to be used as research fund for the projects carried out in college by the faculty of the department. This could serve as the seed for intial trial experiments which could eventually churn out good work for the UGC or the DST funded projects.

The H0-1, formerly Lab technology class room was converted to a research lab cum class room for the PGs. Nov 2008. to 2009 April has five M.Sc project students working under Ms. Mary George, Dr. Mary Terry and Dr. Gowri Sridhar. The lab is being gradually equipped for research. We wish to gain recognition of the Dept as a Research dept from the University so as to help full fledged research work and publications.

National Conference on 'Novel Polymeric Materials'
Organized by Dept of Chemistry, Stella Maris College, Chennai
In collaboration with CLRI, Chennai. (January 20-21, 2009)

Dr. Jesurietta Sathian
Head UG. Dept of Chemistry

The advent of polymers has entirely transformed the way the world functions. While chemists keep churning out tailor made polymers, technologists create limitless applications. The session started with the welcome address by the Principal Dr. Sr. Jasintha Quadras. The inaugural lecture was delivered by Prof. T. M. Aminabhavi, Advisor-Reliance Life Sciences, Mumbai. He gave an interesting review of the Journey of Polymers with special emphasis on their application in Biomedicine. Dr. A. B. Mandal, Director, CLRI, Chennai released the proceedings of the conference and expressed his desire to kindle the scientific spirit in the minds of the budding young scientists. Dr. S. Ramakrishnan, eminent Polymer scientist, from the Indian Institute of Science, Bangalore inaugurated the Poster session.

Prof. S. Ramakrishnan began the session with an insight into the design and synthesis of a unique class of polymers namely dendrimers and hyperbranched Polymers and versatile applications of the same.

The next speaker Dr. T. Narasimhaswamy from CLRI, Chennai gave us in-depth reviews on the design and synthesis of molecules that exhibit thermotropic liquid crystalline properties.

The post-lunch session began with Dr. Saroja Devi from Anna University, Chennai who gave an elaborate account of the exciting chemistry of cyanate ester resins which are shown to exhibit extremely high elastic modulus and tensile strength.

The challenging task of recycling and converting polymers into renewable sources of energy was highlighted by Dr. N. Natchimuthu from Anna University Chennai. He gave us an interesting insight on the relevance of plastics in today's world, issues involved in disposal of plastics and rubber wastes and the various techniques available for recycling them.

The importance of Biomaterials-Polymers in Biomedical applications was highlighted by Dr. Elizabeth Abraham, TTK, Pharma. She focused on the use of polymers in heart valves, bone implants, drug release systems and response of the human body to the biomaterials.

The process of compatibilization of polymer blends and the various compatibilizers used were discussed by Dr. S. N. Jaisankar, from CLRI, Chennai. The experimental techniques adopted and various methods employed in characterization of various polymer blends were described in detail.

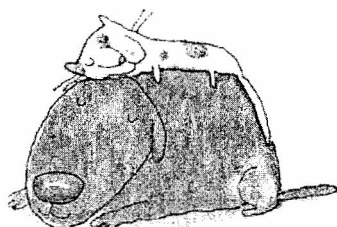
Dr. Balakrishnan from IIT, Madras gave a brief, but interesting lecture on clay-polymer nanocomposites and their important applications.

The study of semiconducting polymers is a newly emerging area and an elaborate and interesting account of their properties, processing methods and applications were discussed by Dr. Susy Varughese from IIT, Madras.

The highlight of the conference was the Panel discussion comprising eminent personalities in the field of Polymer Chemistry from the industrial, research and academic community. Dr. Ganga Radhakrishnan, Director, CCSTDS, Chennai focused on the enormous opportunities for students aspiring for careers in the field of Polymer chemistry. Dr. Rukmani Srinivasan, PG Head, Dept. of chemistry appreciated the overwhelming response from students \scientists for the Conference and attributed this to the emerging trends and enormous potential in the field of Polymer Science. Mr. V. Sekar, Director-Development, Formulated Polymers, Chennai stressed on the challenges involved in marketing of novel polymeric materials. The Panel discussion was interesting and invited a good response from the student community.

The conference ended with the valedictory address by Dr. Ganga Radhakrishnan and distribution of prizes for the best Poster and Participation certificates.

The conference set the platform for fruitful interactions and motivation to contribute to the fabric of life.



Q: What is a cation afraid of?
A: A dogion

LECTURE DEMONSTRATIONS FOR POPULARISATION OF SCIENCE AMONG SCHOOL STUDENTS IN TAMILNADU

9

Dr. Geetha Swaminathan
Vice Principal, Stella Maris College

With the mission of educating the school students to understand and appreciate the importance of science, the Department of Chemistry has been actively organizing Lecture Demonstration for Popularisation of Science among school students from various districts in Tamilnadu, ably coordinated by Dr. Geetha Swaminathan, Reader, Department of Chemistry. The series of lectures is sponsored by National Council for Science and Technology Communication (NCSTC), Department of Science and Technology, Govt. of India, since 2001.

The programmes have been conducted in different parts of the state of Tamilnadu at Trichy, Madurai, Cuddalore, Coimbatore, Chinglepet, Kancheepuram, Vandavasi, Kalpakkam, Vellore, Thiruvellore, Nagapattinam, Velankanni, Villupuram, Thirunelveli, Courtallam, Kurumbanai, Dindigul, Erode, Padappai, Chidambaram, Thanjavur, Tuticorin, Sriperumbudhur and Chennai on interesting topics like Detection of Food Adulteration, Water Analysis, Vermicomposting, Rain Water Harvesting, Environmental Issues, First aid measures, Disaster Management, Wildlife conservation, Food and water borne diseases.

This year, Dr. Geetha Swaminathan coordinated a series of Lecture Demonstrations for popularization of science and technology amongst the students to educate them on the role of Science in Today's Global context and importance of science in everyday life.

The main objectives of the programme were

- ❖ To inculcate a sense of scientific curiosity in the youth and educate the youth to understand and appreciate the beauty of science in everyday life
- ❖ To work towards Scientific Awareness among the youth and reach out to the society
- ❖ To train the students on Safety in Laboratories and Disaster Management
- ❖ To educate the students on Environmental Issues and steps taken towards working for environmental upkeep
- ❖ To reach out to the public, through motivated students and conduct campaigns on Science Awareness
- ❖ To motivate the students to pursue their higher studies in Science

Dr. Geetha Swaminathan, conducted Lecture Demonstrations on Food Adulteration and Water Quality Monitoring at Mary Immaculate High School, Kanyakumari and St. Antony's HSS, Kanyakumari on July 4th, 2008 to students of classes of IX and XI. The programme was attended by about 180 students who were trained on the methods used for detecting food adulteration and the steps that are to be taken to minimize this threat of food adulteration. The students were also trained in Water Quality Monitoring. The chemistry behind the tests were explained in detail and the lectures were highly

appreciated by the youth who have promised to take up such activities as Science club activities in the forthcoming years. She also addressed a batch of students on Safety in Laboratories explaining about the first aid measures to be taken in the science laboratories, safe handling of instruments, and the importance of science.

She also gave lecture demonstrations on Detection and Prevention of Food Adulteration and the Safety Measures at Science Laboratories to students on July 29th, 2008 at Kendriya Vidyalaya, Karaikudi.. Her technical lecture was highly informative and educative which was followed by a lively discussion and interaction.

Ms. MaryGeorge, Senior Lecturer, Dept. of Chemistry, conducted Lecture on Environmental Issues, at St. Antony's HSS, Kanyakumari on July 4th, 2008. She highlighted on the importance of Environmental upkeep, the steps to be taken to protect the environment and the causes and consequences of Global warming and Pollution. She also addressed the students of Carmel Matriculation HSS, Kanyakumari on July 4th, 2008 on Food and Health, highlighting the need for safe food and the health hazards due to adulterants and contaminants. She explained about the role of different implementing agencies in India, which ensure food safety.

Dr. Gowri Sridhar, Lecturer, Dept. of Chemistry, Stella Maris College, addressed a group of students of Mount Zion Matriculation Higher Secondary School, Pudukottai,, on Disaster Management and Environmental Issues. She discussed the various environmental issues and also focused on Tsunami, causes and consequences. The programme was conducted on July 18th, 2008. The lecture highlighted on various environmental issues and the disaster management. The students enthusiastically interacted with the faculty and promised to educate people in their localities about Environmental conservation. She also gave a Lecture on Environmental Issues and Solutions at Sacred Heart Matriculation HSS, Pudukottai on July 18th, 2008. She addressed a batch of students about the causes and consequences of pollution, the role of chemistry in minimizing industrial pollution, solid waste management, water conservation and Energy conservation. The lecture was also conducted in Tamil educating the students about the beauty of Planet Earth and the need to conserve the planet.

Ms. Mary Teresita, Lecturer, Dept. of Chemistry, Stella Maris College, addressed the students of Maharishi Matriculation HSS, Karaikudi on July 29th, 2008. She highlighted on the need for Environmental Conservation and explained about the Green House Effect, Global warming, ozone depletion, water conservation and Rain water harvesting. The lecture was followed by a lively discussion with the students and the feedback indicated that the students would be actively involved in greening the campus and their neighbourhood. She also addressed the students of Subbaiambalam Matriculation HSS, Karaikudi on Environmental Issues and Concerns. She explained the role of an individual and community in protecting the environment.

The programme was coordinated in different districts of Tamilnadu and the other resource persons include, Dr.Rita Jeyaraj, Lecturer, Dept. of Zoology, Stella Maris College, Ms.Shankari, Lecturer(S.G.), Dept. of Chemistry, and Ms.Prabavathy, Lecturer (S.G.) Dept of Physics, Sri Sarada College for Women, Salem, Dr.Rajendran, HOD, Dept of Chemistry, Dr.Sathyabama, Lecturer (S.G.) Dept of Chemistry, and



Ms. Mary George addressing the students of Immaculate High School, Kanyakumari, on Food Safety



Mrs. Gowri Sridhar, Lecturer, Dept. of Chemistry, Stella Maris College, addressing the students of Mount Zion School, Pudukottai, about Environmental Issues and Disaster Management.

Dr. Arockia Selvi, Lecturer (S.G.) Dept. of Zoology, GTN Arts College, Dindugal who addressed the school students on the Importance of Science and Scope of Chemistry, Biological Sciences.

The feedback from the students for all the Lecture Demonstrations indicated that they all enjoyed the lectures and highly appreciated the same. Most of the students have requested that such programmes, which make science interesting and informative, be conducted regularly and be a part of their curriculum. The lecture demonstrations triggered fruitful interaction between the students and the experts. The students would be actively involved in greening the campus and their neighbourhood. The students would also be involved in science club activities and many of them have promised to pursue their higher studies in science and build a better society by educating the public and friends about the various aspects of science. They will definitely be involved in reaching science to the society. The feedback has also indicated that the aptitude of the youth in science activities has increased and they will definitely work with a dream of making India a better nation with scientific approach.

Leaving Your Mark

Rita Mary, III UG

Have you ever dreamt of being a detective as portrayed by television series, finding clues on crime scenes and solving case after case? Did you ever wonder what it took to work in a forensic lab, analysing DNA and making marvellous discoveries? The procedures involved in the aforementioned are beyond the scope of this article, but what we can do is uncover the mystery behind detecting invisible fingerprints!

Four kinds of chemicals are primarily used for detection of fingerprints. These are cyanoacrylate, silver nitrate, iodine, and ninhydrin.

Cyanoacrylate is more commonly known as Super Glue – the very same Super Glue that you'd find at a departmental store contains 98% cyanoacrylate. This has become a very practical and innovative forensic tool. When cyanoacrylate is heated or mixed with sodium hydroxide (NaOH), it releases fumes that interact with the amino acids that are found in the fingerprint residues found on an object, thus making a white print.

After exposure to cyanoacrylate, the fingerprints can then be captured on film as is or treated with a fluorescent pigment that sticks to the fingerprint. The fingerprint then fluoresces, or glows, under a laser or ultraviolet light source.

Silver nitrate is a chemical ingredient found in black-and-white photographic film. When it is applied to a latent fingerprint, the chloride found in fingerprint residue interacts with the silver nitrate and forms another compound called silver chloride. This new compound reveals a black or reddish-brown fingerprint in the presence of ultraviolet light.

The third chemical used to reveal latent fingerprints is iodine. When heated up, crystalline iodine releases iodine fumes into a fuming chamber, where the iodine interacts with the oils found in the latent print thus producing a brownish coloured fingerprint. Unfortunately, this kind of print has a tendency to fade rather quickly. Therefore, it must be captured on film right away or fixed by spraying it with a "fixing solution" made of water and starch. This fixing solution allows the print to last for weeks or even months in lieu of a few minutes.

The last of these chemicals is ninhydrin. It may take several hours for the fingerprints to show up when sprayed with ninhydrin due to the fact that it reacts very slowly with the oils found in the fingerprint. However, heating up the object to a temperature of 80 to 100 degrees Fahrenheit can reduce the reaction time. The resulting fingerprint will be a purple/blue print.

So the next time you see actors on television discovering invisible fingerprints, don't fret – you can do it too!

Cosmetic Talk

Shruthi Thyagarajan
Bhuvaneshwari, IIIUG

Let's take a look at the role of different compounds in the cosmetics we use everyday!

Silica

These are the reasons why silica is used for cosmetics:

Silica contained in foundation adsorbs sweat and oils in skin, which prevents light reflection by sweat/oil and keeps makeup on the skin longer. Spherical particle type of silica improves the smoothness and spreading of foundation and cream. The smooth surface appearance of nail polish is created by silica particles in the polish. Porous silica is used as an ingredient in powder perfume, which can keep the fragrance on the skin for a longer time. Silica is contained in antiperspirant, which gives the smooth feeling after it is applied on the skin.

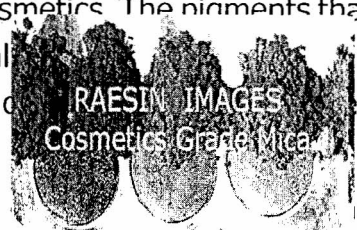


Silica may be used in ways other than the reasons above.

Mica

Mica-based pearl pigments are often used in cosmetics. The pigments that have the luster of natural pearls are generally called pearlescent pigments. People have been using pearl pigment since the 16th century. The ancient Egyptians used the scales of swordfish for the pigments.

Although mica is often thought to have its own color, the different colors of micas are produced by the optical reflection of their multiple layers. The theory behind the colors of mica is same as that of rainbows or soap bubbles (neither the rainbows nor soap bubbles have their own color). We see the different colors through the light interference of the mica base and the thin film of titanium dioxide coating the base. We can create different colors by changing the thickness of the titanium dioxide film.



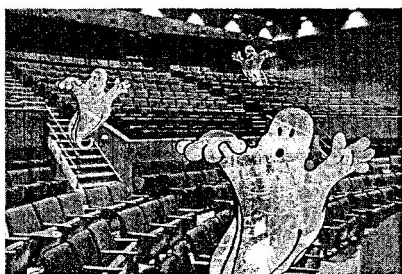
Iron-oxides

Iron oxides have been one of the most commonly used coloring agents for cosmetics for a long time. People have used iron oxides in natural minerals not only for cosmetics but also for religious ceremonies and skin protection. Manufacturing iron oxides as a coloring agent for cosmetics began around 1900.

Iron oxides have various colors which are classified into three major color groups: the yellow iron oxide (yellow), colcothar (red), black iron oxide (black). These iron oxides are fine powders with a slight unique odor. The following table shows the details of the chemical ingredients of each group (each group, especially black iron oxide, does not consist of a single component but instead is a mixture.)

Color tone depends on the temperature, concentration, pH, and radius of the particle when manufactured. For example, different tones of yellow can be produced from yellow iron oxide using these properties.

At present, iron oxides are the most commonly used pigment for coloring cosmetics such as foundation and eye shadow. Various skin colors are produced by mixing these three groups of iron dioxide in different ratios.

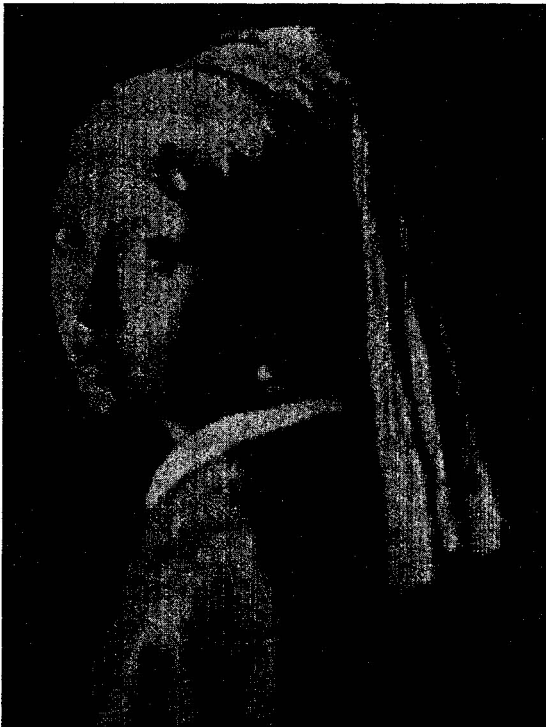


What kind of ghosts haunt chemistry faculties? Methylated Spirits.

From Vermeer Prints to Proteins

Poornima Rangadurai, II UG

Unleash the artist in you – using a laser and proteins! Canadian scientists have recreated the famous painting 'Girl with a Pearl Earring' by Vermeer on the microscale using a new protein patterning technique. This technique can also be



used to mimic patterns of proteins found in cells and could lead to advances in neuroscience, they claim.

Laser-assisted protein adsorption by photobleaching was used to create the protein patterns, and a laser was used to bind a fluorescent compound called biotin-4-fluorescein (B4F) to a protein-coated glass surface. By moving the laser around and varying the intensity of the beam, patterns of B4F were created with varying thickness. Other proteins and antibodies were then bound to the surface to create fluorescent and biologically active protein surfaces.

A dynamic range of protein absorptions are achieved using this technique.

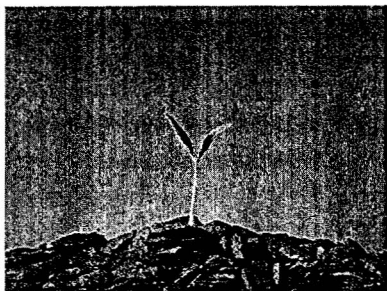
Research has proved that the protein patterns can be used to guide nerve fibres' direction of growth, which will lead to several advances in neuroscience & immunology.

One of the advantages the method is its accessibility - the technology uses equipment readily available in a typical neuroscience lab. Scientists are excited to see if the technique allows patterns of competing signals to be shown to a nerve fibre in real time as the neuron's developmental clock is ticking.

Can Ancient Charcoal Put the Brakes on Global Warming?

Manchali S. Money, III UG

Biochar was first created and used thousands of years ago to help plants grow. Researchers have found that it carbon and is a renewable source of fuel. Nine countries are pouring research dollars into the charcoal-like substance to see if it can sequester carbon, improve the soil and produce biofuels all at once—on an economically competitive scale. Could this ancient fertilizer really put a dent on global warming?



When pre-Columbian natives in the Amazon Basin first began to use Biochar from burning bone fragments and other food remain 7,000 years ago, they knew that it helped their crops grow. But they didn't realize that this charred biomass was extraordinarily good at absorbing and storing carbon dioxide, and that the process that made it released chemicals that could be used as fuel. Today, private companies, universities and government organizations in nine countries—Vietnam, Belize, Cameroon, Chile, Costa Rica, Egypt, India, Kenya and Mongolia—are setting up demonstration trials to evaluate biochar's ability to improve various types of soils while trapping carbon and making fuel to find out if this ancient substance is an economically viable solution to global warming.

Biochar is different from the dry charcoal that you'd burn in a grill: It is produced by heating plant waste to 400 to 500 degrees C in the absence of oxygen by low temperature pyrolysis, which makes a substance that has a greater number of smaller pores than charcoal. The process used to make biochar is a closed, sustainable one: Biomass is fed into the oxygen-free burners and turned into the char. The gases that are released during the reaction are then captured and

converted into electricity from combustible gases or biofuel, while the remaining char is safe to throw directly into the soil. Biochar does the rest of the work underground. The substance improves the ground's composition and fertility by locking in water and nutrients, thereby reducing the need for fertilizers while boosting crop yields. It also stores the carbon from the plant materials that made it— around 50 percent of the carbon produced from converting biomass into biochar can be trapped. In addition to this, it traps even more carbon from decomposing plants in the soil.

What makes biochar so appealing is that it goes beyond ordinary biofuels which balance out carbon dioxide they release when they are burned by that absorbed by the growing biomass. Biochar directly removes carbon dioxide from the atmosphere by stimulating plant growth as well as storing the carbon from decomposing plants in the soil as well as those that were burned to make it for as long as 5,000 years.



How do you make a 24-molar solution?
Put your artificial teeth in water.

Dr. Jesurietta Sathian
Head, UG- Dept of Chemistry

Organic chemistry has long been hailed as an essential ingredient in the fabric of life. The advent of polymer has entirely transformed the way the world functions. While chemists keep churning out tailor made polymers, technologists create limitless applications. Now the polymers are starting to invade the energy sector too by offering bright light through the concept called Organic Electronics.

The present day bulbs are horribly inefficient at converting energy to light (touch one sometime, if you need a reminder). It's rather unfortunate that, in the day of iPods and flash drives, we still rely on bulky bulbs and light comes from a lamp or a ceiling fixture to light our homes. Can this be changed? As light stops coming through the windows after sunset, if only the windows will just start producing their own light!!! that too only in rooms where you're currently spending time !!! Unbelievable, yet it has been made possible through Organic Light Emitting Diodes.

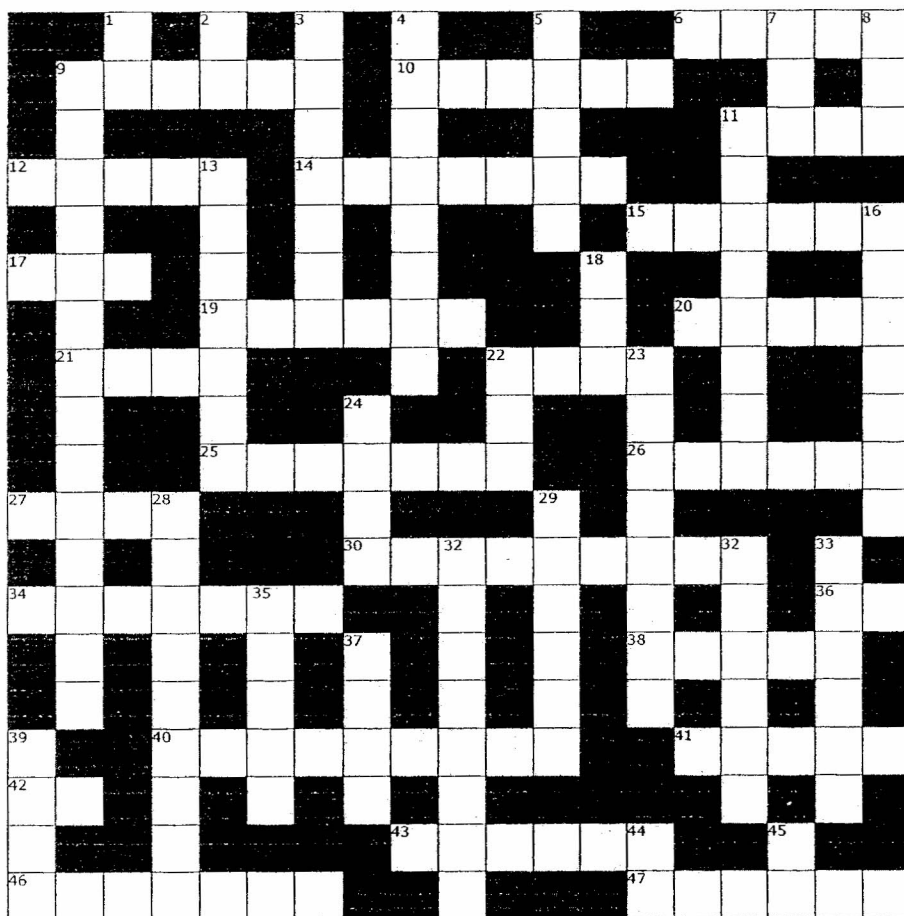
An Organic Light Emitting Diode (OLED) / Light Emitting Polymer (LEP) / Organic Electro Luminescence (OEL), is any Light Emitting Diode (LED) whose emissive electroluminescent layer contains a conductive polymer that emits light when connected to an external voltage source. No vacuum is required, and the emissive organic compounds can be applied on the substrate by a simple technique similar to inkjet printing. The resulting matrix of pixels can emit light of different colors. Molecules commonly used in OLEDs include organo-metallic chelates and conjugated dendrimers.

A significant benefit of OLED displays over traditional liquid crystal displays (LCD) is that OLEDs do not require a backlight to function, thus draw far less power, can operate longer and can be much thinner and less expensive than an LCD panel. OLEDs enable a greater range of colors, brightness, and viewing angle than LCDs because OLED pixels directly emit light. Thus the output in the television screens, small cell phone screens as also the huge displays for advertising \information improves tremendously. Printing OLEDs is such a simple process that the day is not too far when polymers are printed onto flexible substrates like fibre we can strut around with clothing that glow!!!

One disadvantage perhaps, is that lifetime of OLEDs is around 14,000 hours (5 years at 8 hours a day), which is lower than typical lifetime of LCD - about 60,000 hours... Sony became the first company to announce an OLED television in 2007, now followed by Taiwan markets. Soon our homes will profess this path-breaking technology

Crossword

Ms. Janet Xavier,
Faculty Dept. of Chemistry



Across:

6. A kind of isomer (5)
9. A packet of light, perhaps a quantum of light (6)
10. Substance dissolved in a solvent (6)
11. He hates empty orbitals and loves unpaired electrons (4)
12. At this point, a liquid will yield enough vapour to ignite (5)
13. This expression relates the rate of a reaction to the concentration of the reactant (4,3)
15. A radioactive element (6)
17. We extract metals from this (3)
19. Its family members are S, Se, etc (6)
20. $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ (5)
21. By-product of smelting ores to purify metals (4)
22. The most abundant element on earth (4)
25. Subatomic particle that has no charge (7)

26. It holds the active principle in a tablet (6)
27. Its outer electronic configuration is $3d^{10} 4s^2$ (4)
30. Creator of the first version of the periodic table (9)
34. Carbon that shines a lot (7)
36. The last member of Group 13 elements (2)
38. Radioactive elements emit this particle (5)
40. Subatomic particles with negative charge (9)
41. These are burned to obtain energy (5)
42. Search for much a needed word, also a symbol for a lanthanide (2)
43. An alkali metal (6)
46. A type of complex (3,4)
47. This counter detects radiation (6)

Down:

1. Hydroxide (2)
2. Follower of Pd & Ni – just the symbol! (2)
3. Randomness of a system, so to speak (7)
4. C13 & C14, H2 & H3 (8)
5. A 5-membered heterocyclic (5)
7. Atomic mass unit (3)
8. The first three types of orbitals – sphere, dumbbell and double dumbbell (3)
9. Characteristic of anions whose electron clouds get distorted by a nearby ion or dipole (14)
11. Leads the alkali metals but is not a true alkali metal itself (7)
13. Group 17 element (7)
16. A sample of matter composed of two or more substances (7)
18. Scale to determine hardness (3)
22. A charged species (3)
23. Argon is an example of this (8)
24. Particle of an element (4)
28. Ligands coordinate with metals to form these (9)
29. Cr, Mn, Li, Na, etc (6)
31. The largest constituent of the Earth's atmosphere (8)
32. Gaseous water is also called water ____ (6)
33. A system in its lowest energy is thermodynamically ____ (6)
35. Points of zero electron density (5)
37. 8-membered (4)
39. Basic unit of all living systems (4)
44. Alkaline earth, used to prepare Grignard's Reagents – Just the symbol! (2)
45. Argentum – Just the symbol! (2)

Microwave Chemistry: A New Technique in Drug Discovery

Dr. Maha Sampath Gowri
Faculty, Department of Chemistry

This technology opens up new opportunities to the synthetic chemist, in the form of new reactions that are not possible using conventional heating, improved reaction yields, decreased reaction times and even solvent free reaction conditions.

Microwave oven has been used routinely as domestic appliance for rapid heating of foodstuffs. However, people have recognized other potential applications for this method of heating and scientists engaged in a number of disciplines have applied the rapid heating associated with microwave technology to a number of useful processes. These include the preparation of samples for analysis, application to waste treatment, polymer technology, drug release/targeting and ceramics. The technique has also found use in a range of decomposition processes including hydrolysis of proteins and peptides

Microwave dielectric heating uses the ability of some liquids and solids to transform electromagnetic radiation into heat to drive chemical reactions. This technology opens up new opportunities to the synthetic chemist, in the form of new reactions that are not possible using conventional heating, improved reaction yields, decreased reaction times and even solvent free reaction conditions. Both the domestic microwave oven as well as automated microwaves has been used. The vessels used for carrying out microwave reactions are generally made up of pyrex or PTFE.

The use of water as a solvent in microwave reactions is appealing and has been noted by several groups. Other solvents such as dimethyl formamide (DMF), acetonitrile (MeCN) and dichloromethane (DCM) are also useful for particular kind of reactions but obviously there are certain limitations to each. It has been shown that with microwave radiation solvents can be heated above their boiling points and it may be argued that it is this form of superheating which leads to observed rate enhancements for many reactions.

Since mid-1990s, the number of publications related to microwave chemistry has increased significantly. This technology has made an impact in several areas of drug discovery related to organic synthesis and it has also been used in target discovery,

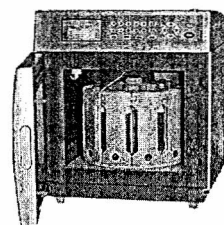
screening and pharmacokinetics. It is also used by pharmaceutical companies to produce compound libraries and has found application in peptide synthesis.

Applications in organic chemistry

Microwave assisted organic synthesis is an increasingly popular field which has shown potential to carry out variety of reactions such as pericyclic reactions (Diels-Alder, Claisen and ene reactions), cyclization, condensation, oxidation, and molecular rearrangements etc. A number of examples of microwave assisted organic transformations have been reported in the literature.

The Diels Alder reaction of anthracene with dimethyl fumarate proceeds in 10 minutes with 87 per cent yield as compared to four hours with 67 per cent yield under conventional conditions. Its role in process chemistry is increasing, especially in cases where classical methods require forcing conditions or prolonged reaction times.

Microwaves have also shown an advantage where processes involve sensitive reagents or there is possibility of compound decomposition under prolonged reaction conditions. Major advantages of these reactions over conventional reactions are striking reduction in reaction times, good yields and cleaner reactions. The possibilities for automation are clear and the opportunities for executing numerous reactions at the same time in the same microwave cavity is attractive if large numbers of compounds need to be prepared rapidly. It is likely that, with increased activity in this exciting area, widespread acceptance of this technology will result in the microwave oven becoming an integral part of every modern organic synthesis laboratory.



Applications in pharmaceutical sciences

To increase drug solubility: The human body must absorb a drug in order to make it bioavailable, and in oral treatments absorption takes place, after drug dissolution, by diffusion of the molecules through the gastrointestinal (GI) membranes. Since the GI tract is an aqueous environment and more than one third of the existing drugs are poorly soluble or insoluble in water, solubilization of water-insoluble drugs is a big issue of pharmaceutical research.

The key-concept of solubilization is to force the insoluble solid to assume a microstructure characterized by nanoscale periodicity. The use of microwave heating was found to be a green and effective tool for generating drug dispersion in stabilizing media. With few exceptions pharmaceutical (organic) materials are diamagnetic and dielectric, i.e. are suitable for microwave heating. This environmentally friendly microwave-induced diffusion for generating activated drug/3D-matrix nanocomposites has solved the bioavailability-linked problems associated with insoluble drugs.

Synthesis of pharmacologically active drug molecules: The use of microwave for synthesis of drug molecules is well established. For e.g. 3-aryl-4-hydroxyquinolin-2 (1H)-ones have recently been found to serve as key intermediates in the synthesis of non-peptide GnRH (Gonadotropin releasing hormone) receptor antagonists. Such compounds have potential for treatment of sex hormone related conditions.

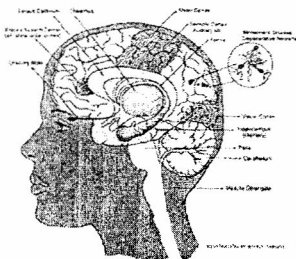
The synthesis of 3-aryl-4-hydroxyquinolin-2 (1H)-ones requires many hours at reflux temperatures in a high boiling organic solvent (e.g. diphenyl ether) under classical conditions while the same reaction was found to be completed in 15 minutes under solvent-free conditions with the use of microwave energy. - Preparation of radiopharmaceuticals: Radiopharmaceuticals that contain isotopes with short half-lives have been synthesized by activation with the use of microwave energy. Microwave has been successful in reducing reaction times by up to 50 per cent with improved radiochemical yield of the final product. This technology is still under used in the laboratory and has a potential to have large impact on the fields of screening, combinatorial chemistry and drug development. Whether this potential is unleashed or not is dependent upon the change in the approach of experimentalists.



Why do white bears dissolve in water? Because they're polar.
Q: What's the most important thing to learn in chemistry?
A: Never lick the spoon.
Q: Why are chemists great for solving problems?
A: They have all the solutions.

Hope for Alzheimer's Patients?

Sherin, 1 PG



Alzheimer's disease is posing a grave threat to health and social systems worldwide. With longer life spans brought on by better standards of living, this disease is one of the challenges in geriatric care. Scientists suggest that having steady but limited quantities of Red Wine may be beneficial for the heart, and shows signs of warding off certain

tumours as well as Alzheimer's disease.

It has been shown how naturally occurring chemicals in red wine called polyphenols block the formation of proteins that build the toxic plaques thought to destroy brain cells. It further explains how they reduce the toxicity of existing plaques, thus reducing cognitive deterioration.

Polyphenols comprise a chemical class with more than 8,000 members, many of which are found in high concentrations in wine, tea, nuts, berries, cocoa and various plants. Past research has suggested that such polyphenols may inhibit or prevent the build-up of toxic fibers composed primarily of two proteins — A β 40 and A β 42 — that deposit in the brain and form the plaques which have long been associated with Alzheimer's. Until now, however, no one understood the mechanics of how polyphenols worked.

Researchers have been studying how amyloid beta (A β) is involved in causing Alzheimer's. In this work, they have monitored how A β 40 and A β 42 proteins folded up and stuck to each other to produce aggregates that killed nerve cells in mice. They then treated the proteins with a polyphenol compound extracted from grape seeds. They discovered that polyphenols carried a one-two punch: They blocked the formation of the toxic aggregates of A β and also decreased toxicity when they were combined with A β before it was added to brain cells.

They discovered that if the A β proteins can't assemble, toxic aggregates can't form, and thus there is no toxicity. Work done suggests that administration of the compound to Alzheimer's patients might block the development of these toxic aggregates, prevent disease development and also ameliorate existing disease.

Coloured Glass Chemistry

Anitha T., III UG



Glass is colored by purposely introducing minerals or purified metal salts (pigments) in addition to natural impurities. Examples of popular colored glasses include ruby glass (invented in 1679, using gold chloride) and uranium glass (invented in the 1830s, glass that glows in the dark, made using uranium oxide).

Sometimes it is necessary to remove unwanted color caused by impurities to make clear glass or to prepare it for coloring. Decolorizers are used to precipitate out iron and sulfur compounds. Manganese dioxide and cerium oxide are common decolorizers.

Many special effects can be applied to glass to affect its color and overall appearance. Iridescent glass, sometimes called iris glass, is made by adding metallic compounds to the glass or by spraying the surface with stannous chloride or lead chloride and reheating it in a reducing atmosphere. Ancient glasses appear iridescent from the reflection of light off of many layers of weathering.

Dichroic glass is an iridescent effect in which the glass appears to be different colors, depending on the angle from which it is viewed. This effect is caused by applying very thin layers of colloidal metals (e.g., gold or silver) to the glass. The thin layers are usually coated with clear glass to protect them from wear or oxidation.

Compounds	Colors
iron oxides	greens, browns
manganese oxides	deep amber, amethyst, decolorizer
cobalt oxide	deep blue
gold chloride	ruby red
selenium compounds	reds
carbon oxides	amber/brown
mix of manganese, cobalt, iron	black
antimony oxides	white
uranium oxides	yellow green (glows!)
sulfur compounds	amber/brown
copper compounds	light blue, red
tin compounds	white
lead with antimony	yellow

Chemistry Makes Shuttle Flights Safer

Article originally from American Chemistry magazine.



It isn't easy to keep space shuttles in mint condition —this is but one arena where chemistry plays a very significant role. Crew safety is top priority at the National Aeronautics and Space Administration (NASA), which oversees USA's shuttle program. Since NASA resumed flights in 2005, space flight implementation has seen several improvements with great care being taken to ensure the shuttle's safe re-entry to Earth.

The shuttle consists of three major physical elements: a large external tank, two solid booster rockets, and the orbiter. The orbiter is the only part of the shuttle that returns home. During re-entry into the Earth's atmosphere, the orbiter travels more than 17,000 miles per hour, with exterior temperatures reaching up to 3,000° F. All external surfaces of the orbiter are protected by an assortment of thermal protection system (TPS) materials. These include reinforced carbon-carbon (RCC), low- and high-temperature reusable surface insulation tiles, felt reusable surface insulation blankets, and fibrous insulation blankets. RCC is the primary material used. It is found on the wing's leading edges, the nose cap, including an area just behind the nose cap on the lower surface, as well as the area immediately surrounding the structural attachment points connecting the orbiter to the external fuel tank.

The RCC composite is a laminate of graphite-filled rayon fabric, which is then filled with phenolic resin. The outer layers of the carbon substrate are covered in a layer of silicon carbide to prevent oxidation. An aluminium skin that measures 0.1 inches covers the external tank. This skin is covered with polyurethane-like foam averaging one inch in thickness. The foam insulates the propellants, prevents ice formation, and protects the tank from aerodynamic heat during flight.

NASA's improvement of the TPS includes 22 temperature sensors distributed along the leading wing edges. A new technique called flash thermography is also being used to assess RCC panels. In the event damage to the TPS could occur during a mission, NASA began developing several on-the-go, in-flight repair options that allows astronauts to address any problem prior to re-entry.

Chemical systems involve substances applied in a raw form, which develop a chemical adhesive bond with the existing protection systems. These methods need to be tested in space to ensure their usability.

Among these were an emittance wash applicator for tile repair and non-oxide adhesive experimental (NOAX) for the RCC samples. The emittance wash applicator uses a material developed primarily for shallow tile damage. The wash comprises fine-grit silicon carbide granules mixed with a room temperature vulcanizing material. It is applied to exposed tile substrate and embeds itself into it, creating a strong adhesive bond and high heat-rejection value.

NOAX uses a pre-ceramic polymer sealant impregnated with carbon-silicon carbide powder. It is designed to fix damage caused by small pieces of foam falling off the redesigned external tank. It is not intended to repair holes, but rather to refill cracks or coating losses. Several other options—including flexible adhesive patches and small area repair plugs for RCC, as well as hardening of the existing tile system coating—are also being tested and evaluated with the goal of making space travel risks minimal. And to this endeavour, Chemistry has a lot to contribute.

No Test Tubes, No Effervescences - Only the Magic of Numbers

Dr. Rukmani Srinivasan
Head, PG. Department of Chemistry

The chemistry of numbers--or, more precisely, the numbers in chemistry- A "quantum chemist," appropriately captures the quasi-chemistry and quasi-physics, that the balance is tipped finally in favor of chemistry, though, for the issue here is molecules and their interactions. Yet the investigations deal with these conglomerations of atoms by solving equations that are themselves designed to describe the behavior of subatomic particles.

Here is another dimension numbers that are magical!

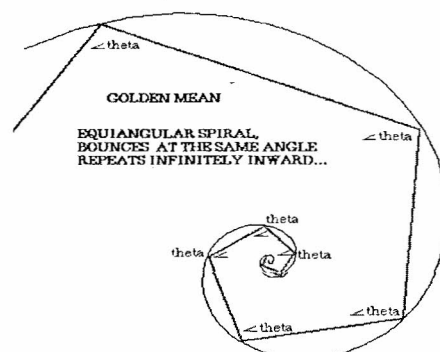
There are magic numbers in the composition of the nucleus and electrons in all elements.

- ♦ The magic numbers are 2, 8, 20, 28, 82, and 126.
- ♦ Nuclei that contain magic numbers of both protons and neutrons are even more stable and are said to be "doubly magic". The magic numbers are 2, 8, 20, 28, 50 and 82.
- ♦ Isotopes (with the nucleus varying only in terms of neutrons) tend to be stable when they have the magic numbers, even numbers, equal numbers of protons and neutrons, and odd numbers of neutrons, and 64 neutrons in descending order of preference.
- ♦ The unusual stability of isotopes having magic numbers means that transuranium elements can be created with extremely large nuclei and yet not be subject to the extremely rapid radioactive decay normally associated with high atomic numbers (as of 2007, the longest-lived, known isotope among all of the elements between 110 and 120 lasts only 12 min., next 22 sec.). Large isotopes with magic numbers of nucleons are said to exist in an island of stability.
- ♦ A molecule wants to revert to its preferred state, which is the number of electrons held by the noble gas closest to it. That is why O has 6 outer (valence) electrons, and wants to add 2 to get to the magic number of 8. That's why water is H₂O, not H₃O. As a corollary, sodium has 9 electrons, and wants to give one away to get back to 8.
- ♦ The nucleus is an inherently unstable area, with all the positive charges compacted in a very small space. Neutrons stabilize the nucleus, in a 1:1 ratio for most of the small elements. As the nucleus grows, more neutrons are required for stability. Different numbers of neutrons cause the formation of isotopes. The importance is that the magic numbers appear in much larger concentrations, are much more prevalent and long lived.

- ♦ Nuclear physicists have created an isotope of silicon that contains twice as many neutrons as protons. Measurements made with silicon-42 - which contains 14 protons and 28 neutrons - shed new light on the concept of "magic numbers" in nuclei (Nature 435 922). The results show that the silicon-42 nucleus remains stable despite containing a large excess of neutrons. The data also suggest that the proton number 14 is semi-magic because it corresponds to a closed subshell, which means that the nucleus is also spherical.

Double magic

- ♦ Nuclei which have both neutron number and proton (atomic) number equal to one of the magic numbers are called "double magic", and are especially stable against decay. Examples of double magic isotopes include helium-4 (${}^4\text{He}$), oxygen-16 (${}^{16}\text{O}$), calcium-40 (${}^{40}\text{Ca}$), calcium-48 (${}^{48}\text{Ca}$), nickel-48 (${}^{48}\text{Ni}$) and lead-208 (${}^{208}\text{Pb}$).
- ♦ The following are doubly magic but this has no unusual effect on their stability: tin-100 (${}^{100}\text{Sn}$) & tin-132 (${}^{132}\text{Sn}$). It is no accident that helium-4 (${}^4\text{He}$) is among the most abundant (and stable) nuclei in the universe and that ${}^{208}\text{Pb}$ is the heaviest stable nuclide.
- ♦ Both calcium-48 (${}^{48}\text{Ca}$) and nickel-48 (${}^{48}\text{Ni}$) are double magic because calcium-48 has 20 protons and 28 neutrons while nickel-48 has 28 protons and 20 neutrons. Calcium-48 is very neutron-rich for such a light element, but is made stable by being double magic. Similarly, nickel-48, discovered in 1999, is the most proton-rich isotope known.
- ♦ In December 2006 Hassium-270 (${}^{270}\text{Hs}$) was discovered by an international team of scientists led by the Technical University of Munich having the unusually long half-life of 22 seconds. Hassium-270 evidently forms part of an island of stability, and may even be double magic.



Explaining carbon-cluster magic numbers

When graphite is vaporized by a laser, the liberated carbon atoms are found to be clumped together in remarkably specific numbers: If more than 40 atoms make up a cluster, then an even number will be in the clump, while in smaller clusters, certain "magic numbers"--11, 15, 19 and 23--are most common. For years chemists have debated the origin and structure of these clusters, especially those in the 40-plus range. To explain the high prevalence of C_{60} clusters, for example, some researchers had proposed a soccer-ball-like structure called buckminsterfullerene

A structural magic numbered cluster possesses unusual stability. Why is this? Starting with the first magic numbered cluster, one atom surrounded by 12. This gives the first magic number = 13. This cluster is expected to be more stable than a cluster with 12 atoms or 14 atoms. Where would the 14th atom be placed in this structure? For the 13- atom cluster, there is only one true volume atom– the rest are surface atoms. The surface-to-volume ratio is then $12/13$ or 92.3%.

Each type of crystal is able to generate a series for calculation of magic number clusters.

Nanocluster Size-Control and "Magic Number" Investigations.

Experimental Tests of the "Living-Metal Polymer" Concept and of Mechanism-Based Size-Control Predictions Leading to the Syntheses of Iridium(0) Nanoclusters Centering about Four Sequential Magic Numbers

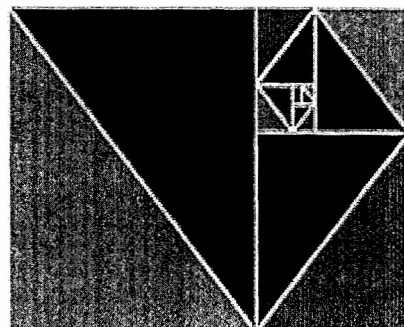
†The autocatalytic surface growth should tend to favor so-called "magic-number" size (i.e., closed shell; higher stability) nanoclusters; and that it should be possible to prepare, for the first time, a sequential series of nanoclusters centering about the transition metal magic-number nanocluster sizes, M13, M55, M147, M309, M561, M923 (and so on). These mechanism-based predictions are tested via this work. The end result is the synthesis of an unprecedented sequential series of Ir(0)_n nanocluster distributions centering about four sequential transition-metal magic numbers, specifically Ir(0) One can in principle rationally design and then synthesize all possible geometric isomers of bi-, tri-, and higher multimetallic transition-metal nanoclusters, each in an initially known, layered, "onionskin" structure.

A SMALL PUZZLE

1. Think of any two numbers. (a,b).
2. Make a third by adding the first and second ($c = a+b$),
3. A fourth by adding the second and third ($d = b+c = b+a+b$), and so on.
4. When you have written down about 20 numbers ($t = s + r$),
5. Calculate the ratio of the last to the second from last.
6. The answer should be close to 1.6180339887.

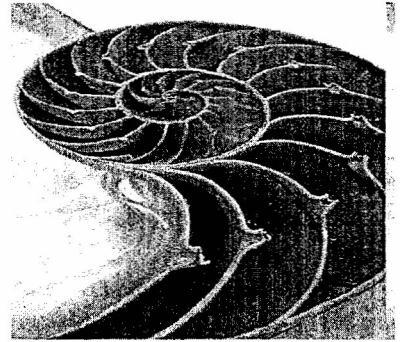
1.6180339887 is the "golden ratio"

- ♦ It crops up in more places in art, music and so on than any number except pi.
- ♦ Claude Debussy used it explicitly in his music and Le Corbusier in his architecture.
- ♦ This number was used by Leonardo da Vinci in the painting of the Mona Lisa,
- ♦ Used by the Greeks in building the Parthenon
- ♦ Used by ancient Egyptians in the construction of the Great Pyramid of Khufu.



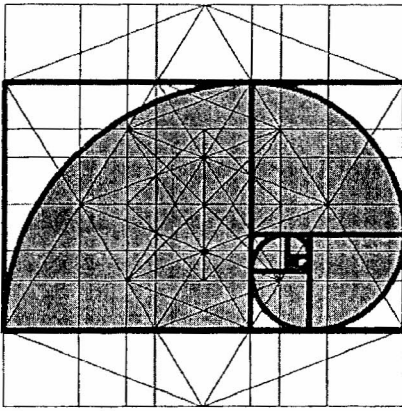
What makes the golden ratio special is the number of mathematical properties it possesses. The golden ratio is the only number whose square can be produced simply by adding 1 and whose reciprocal by subtracting 1.

- ❖ If you take a golden rectangle - one whose length-to-breadth is in the golden ratio - and snip out a square, what remains is another, smaller golden rectangle.
- ❖ The golden ratio is also difficult to pin down: it's the most difficult to express as any kind of fraction and its digits - 10 million of which were computed in 1996 - never repeat.
- ❖ The most surprising thing is that a number deemed aesthetically pleasing by human beings also crops up in nature and science. Take the arrangement of leaves on the stem of a plant. As each new leaf grows, it does so at an angle offset from that of the leaf below. The most common angle between successive leaves is 137.5 - the golden angle. Why? Because $137.5 = 360 - 360/G$, where G is the golden ratio. Why does the golden ratio play a role in the arrangement of leaves? It's all down to the "irrationality" of the number. Irrational numbers are ones that cannot be expressed as the ratio of two whole numbers - for instance, $5/2$.
- ❖ "The golden ratio is the slowest of all continued fractions to converge," says Livio. This turns out to be the key property. A new leaf must collect sunlight without throwing the leaves below it into too much shadow. A plant must arrange its leaves in such a way that the greatest number can spiral around the stem before a new leaf sprouts immediately above a lower one - that is offset at 360.
- ❖ "The golden ratio is arguably the most irrational of all irrational numbers," says Livio. This can be said more precisely. Irrational numbers can be expressed as continued fractions - basically an infinite series of ever-diminishing terms. As each successive term is added, the continued fraction converges towards a single value.



The golden ratio also crops up in the hard sciences. Take the growth of "quasi-crystals". These have "five-fold symmetry", which means they make a pattern that looks the same when rotated by multiples of one-fifth of 360. In the 1990s, physicists in Switzerland and the US imaged the microscopic terrain of the surface of such crystals. They found flat "terraces" punctuated by abrupt vertical steps. The steps come in two predominant sizes. The ratio of the two step heights? The golden ratio!

The Divine Proportion, that was crucial in disseminating the golden ratio beyond the world of mathematics. Da Vinci was a friend of Pacioli's and almost certainly would have read the book, hence the claim that he painted the face of the Mona Lisa to fit inside a hypothetical golden rectangle. "Of course, it all depends on how you draw the rectangle!" says Mario Livio, who has written a book called *The Golden Ratio* and who is head of science at Baltimore's Space Telescope Science Institute.



It was this elusive nature that led the 15th-century Italian friar and mathematician Luca Pacioli to equate the golden ratio with the incomprehensibility of God.

Dan Winter's Golden Section / DNA Theories His theory is that the PHI Geometry of DNA implies a wave-form preference for Phi-fractal self-embeddedness. He relates this semi-proven phenomenon to the human properties of consciousness and love!

Even Pythagoreans may have known of the association of the golden ratio with five-fold symmetry. The symbol of their cult was the five-pointed star, and the ratio of the length of the side of each triangular point to its projected base is the golden ratio.

Perhaps the most surprising place the golden ratio crops up is in the physics of black holes, a discovery made by Paul Davies of the University of Adelaide in 1989. Black holes and other self-gravitating bodies such as the sun have a "negative specific heat". This means they get hotter as they lose heat. Basically, loss of heat robs the gas of a body such as the sun of internal pressure, enabling gravity to squeeze it into a smaller volume.

Things are not so simple, however, for a spinning black hole, since there is an outward "centrifugal force" acting to prevent any shrinkage of the hole. The force depends on how fast the hole is spinning. It turns out that at a critical value of the spin, a black hole flips from negative to positive specific heat - that is, from growing hotter as it loses heat to growing colder. What determines the critical value? The mass of the black hole and the golden ratio!

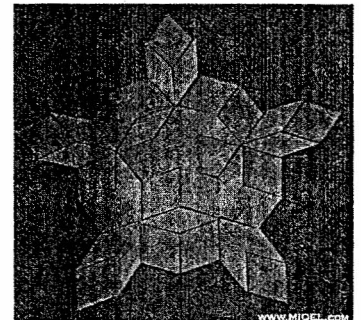
Why is the golden ratio associated with black holes? "It's a complete enigma," Livio confesses. Shakespeare said it all: "There are more things in heaven and earth..."

The magic numbers is a huge science with vast coverage and interpretations. One could slowly slip in to a huge black hole which might open up a Pandora's box of entirely new exciting worlds which are highly networked and yet, there should be a few fundamental connectivities between several fields through numbers!

The magic numbers is a huge science with vast coverage and interpretations. One could slowly slip in to a huge black hole which might open up a Pandora's box of entirely new exciting worlds which are highly networked and yet, there should be a few fundamental connectivities between several fields through numbers!

In Finance

Shades of Osborne. are there certain numbers that occur much too often in the distribution of stocks. Do stocks tend to gravitate back to these numbers and do they act as barriers. A recent article in the Journal of Futures Markets, "Clustering in the Futures Market: Evidence from S&P 500 Futures Contracts by Adam Schwartz and Bonnie Van Ness and Robert Van Ness talks about prevalence at round numbers.

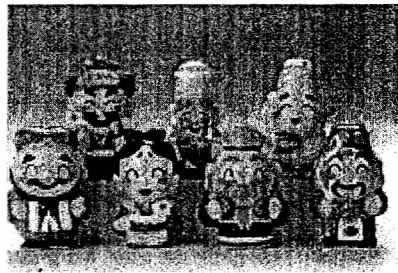


Can it be profitable by buying and selling the unstable and stable numbers between and within days? If it can lead to discovery of two new elements?!

This is easily modeled in stock actions near a round number, it wants to rise to 100, but if it goes too far past, it will give some back.

Japan's Magic Numbers

Like in other countries Japan has Magic Numbers too, some good and others not so good, superstitions.



Number 7:

Seven is a lucky number and most used in Japanese culture, for example the "Shichi Fuku Jin"; the seven Japanese Gods of happiness and luck,

Others relation with number 7:

- ❖ On January 7th nanakusagayu is eaten (rice porridge with seven herbs) to ward off evil for the coming year, in addition to inviting good luck and longevity
- ❖ A baby's birth is celebrated on the 7th day
- ❖ A death is mourned for seven days and again, after seven weeks
- ❖ In Buddhism, the main religion of Japan, people believe in seven reincarnations
- ❖ There is a saying: "nana korobi ya-oki" which means fall down seven times, get up eight times. Life has its ups and downs; more ups than downs, so persevere when things are tough and you will surely get through them.

The above are only samples and one can get more such if one reads Japanese culture.

Sports and magic number

In certain, a magic number is a number used to indicate how close a front-running team is to clinching a season title. It represents the total of additional wins by the front-running team or additional losses by the rival team after which it is mathematically impossible for the rival team to capture the title in the remaining games. This assumes that each game results in a win or a loss, but not a tie. Teams other than the front-running team have what is called an elimination number (or "tragic number") (often abbreviated E#). This number represents the number of wins by the leading team or losses by the trailing team which will eliminate the trailing team. The elimination number for the second place team is exactly the magic number for the leading team.

The magic number is calculated as $G + 1 - WA - LB$, where

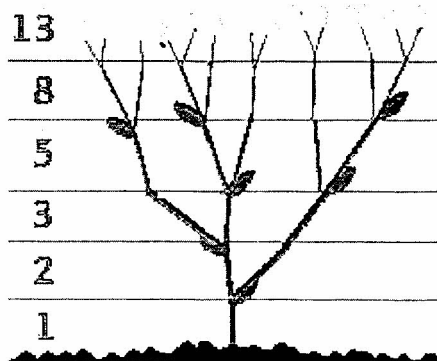
- ❖ G is the total number of games in the season
- ❖ WA is the number of wins that Team A has in the season
- ❖ LB is the number of losses that Team B has in the season

CONCLUSION

SOME NUMBERS THAT EMERGE AS MAGIC

- (i) 2, 8, 20, 28, 82, and 126
- (ii) even numbers,
- (iii) equal numbers of protons and neutrons,
- (iv) odd numbers of neutrons
- (v) 64 neutrons
- (vi) Magic number of 8.
- (vii) 2, 8, 20, 28, 50 and 82 are doubly magic!
- (viii) Double Magic- helium-4 (^4He), oxygen-16 (^{16}O), calcium-40 (^{40}Ca), calcium-48 (^{48}Ca), nickel-48 (^{48}Ni) and lead-208 (^{208}Pb). 270 (^{270}Hs)
- (ix) Nanocluster-9
- (x) magic-number nanocluster sizes, M13, M55 M147, M309, M561, M923
- (xi) Ir(0)
- (xii) Japan's Magic Numbers: 4 and 666 not good (satanic no; Christians also believe in this) and many more. While 7 is very lucky!
- (xiii) 1.6180339887 is the "golden ratio"

The magic numbers is a huge science with vast coverage and interpretations. One could slowly slip in to a very deep hole which might open up entirely new exciting worlds which are highly networked and there should be a few fundamental connectivities between several fields through numbers! Lots more to be explored!!!



Chemical Robots

Pavalakodi & Sindhu T
III UG



In 2008, the Defense Advanced Research Projects Agency (DARPA) invited proposals to develop new Chemical Robots (ChemBots), using soft and flexible materials to enable machines to change their size and shape to squeeze through gaps smaller than their own normal dimensions. While the concept may sound unusual at first, shape-shifting mobile machines have very real military purposes.

"The ability to safely and covertly gain access to denied or hostile areas and perform useful tasks provides critical advantages over a broad spectrum of military operations," reads DARPA's solicitation. "An effective and logistically attractive means for gaining entry is to deploy an unmanned platform, such as a robot. However, the only available points of entry are small openings in buildings, walls, under doors, etc."

DARPA suggests a robot built for such purposes would need to be soft enough to squeeze through these gaps, but large enough to carry important equipment. "Current robotic platforms are constructed primarily of hard materials and, while capable of locomotion with embedded payloads, cannot change their physical dimensions," the solicitation says.

In some respects, the idea is to imitate nature. Different types of 'soft' animals — including some mice, insects, and octopuses — squeeze nimbly through tiny gaps. They use a variety of natural 'reversible mechanisms,' including elastic tissues, flexible musculoskeletal structures, and body parts that can be changed from stiff to flexible and vice versa. Another factor is locomotion itself. Soft invertebrates employ various means to grip and crawl along surfaces. Earthworms and caterpillars use

peristalsis, involving wavelike muscular movements; snails and slugs perform pedal waves; and many tinier organisms use ciliary motions, vibrating their eyelash-like structures.

DARPA is asking robotics experts for innovative proposals to combine their own expertise with that of soft materials chemistry. Specifically, a ChemBot must be able to

1. Travel some distance.
2. Pass through an opening that is arbitrarily shaped and much smaller than the robot's own largest dimension.
3. Reconstitute its original shape, size, and functionality on the other side.
4. Travel another distance.
5. Perform a function involving its embedded payload.

Achieving these results will require new technological breakthroughs, including materials, systems, and/or architectures that can not only move, but also 'morph' in three dimensions.

Glowing Proteins - Guiding Stars

Dr. Maha Sampath Gowri
Faculty, Department of Chemistry

Tens of thousands of different proteins reside in a living organism, controlling important chemical processes in minute detail. If this protein machinery malfunctions, illness and disease often follow. That is why it has been imperative for bioscience to map the role of different proteins in the body.

This year's Nobel Prize in Chemistry rewards the initial discovery of GFP and a series of important developments which have led to its use as a tagging tool in bioscience. By using DNA technology, researchers can now connect GFP to other interesting, but otherwise invisible, proteins. This glowing marker allows them to watch the movements, positions and interactions of the tagged proteins.

Researchers can also follow the fate of various cells with the help of GFP: nerve cell damage during Alzheimer's disease or how insulin-producing beta cells are created in the pancreas of a growing embryo. In one spectacular experiment, researchers succeeded in tagging different nerve cells in the brain of a mouse with a kaleidoscope of colours



The story behind the discovery of GFP is one with the three Nobel Prize Laureates in the leading roles:

Osamu Shimomura first isolated GFP from the jellyfish *Aequorea victoria*, which drifts with the currents off the west coast of North America. He discovered that this protein glowed bright green under ultraviolet light.

Martin Chalfie demonstrated the value of GFP as a luminous genetic tag for various biological phenomena. In one of his first experiments, he coloured six individual cells in the transparent roundworm *Caenorhabditis elegans* with the aid of GFP.

Roger Y. Tsien contributed to our general understanding of how GFP fluoresces. He also extended the colour palette beyond green allowing researchers to give various proteins and cells different colours. This enables scientists to follow several different biological processes at the same time.

The prize amount, SEK 10 million, will be shared equally between the laureates.

The green fluorescent protein GFP consists of 238 amino acids, linked together in a long chain. This chain folds up into the shape of a beer can. Inside the beer can structure the amino acids 65, 66 and 67 form the chemical group that absorbs UV and blue light, and fluoresces green.

Adapted from materials provided by Nobel Foundation.

THE ROLE OF HIV-1 PROTEASE AS AN ENZYME INHIBITOR

39

Dr. RITA JAYARAJ

Faculty, Dept. Of Advanced Zoology & Biotechnology

INTRODUCTION

HIV (human immunodeficiency virus) causes AIDS (acquired immunodeficiency syndrome) by attacking T-helper cells in the body.

HIV first attaches itself to a cell in the host and releases RNA into the host cell. This RNA is transcribed into DNA by the viral enzyme called reverse transcriptase. Once this DNA becomes part of the host cell's genome, it can start to produce more viral RNA and proteins, proteins which act as packaging for the newly formed RNA. Most of these viral proteins are produced as part of a larger polypeptide precursor known as polyproteins. Essentially what this means is that another enzyme is needed at this point to release the viral proteins from their packaging, allowing them to reproduce. The enzyme that opens these protein packages, allowing for reproduction, is known as HIV protease.

Inhibition of Reverse Transcriptase Several inhibitors for reverse transcriptase have been developed, including AZT, ddC, ddI, and nevirapine. The enzyme inhibitors AZT, ddC, and ddI are taken up by cells and incorporated directly into the DNA chains that were synthesized from the HIV template by reverse transcriptase. These three inhibitors essentially act as chain terminators, that is, they stop the production of viral RNA. Nevirapine does not bind to the reverse transcriptase, but binds to a different place on the enzyme, though Nevirapine's action is essentially the same as the other three inhibitors.

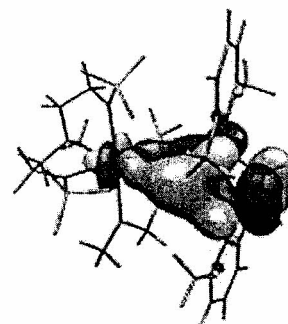
Inhibition of HIV Protease The HIV protease inhibitors that have been developed include Saquinavir and Ritonavir. Both of these inhibitors contain bulky groups such as phenyl rings that bind in the HIV protease active site. When these bulky groups bind with the enzyme they essentially render the enzyme ineffective since the intended substrate (the polyproteins consisting of viral RNA and proteins) can not come into contact with the enzyme's active site. Thus, the RNA can not be released and subsequent reproduction of the viral RNA can not occur.

CONCLUSION: HIV-1 protease as a drug target with its integral role in HIV replication, HIV PR has been a prime target for drug therapy. HIV PR inhibitors work by specifically binding to the active site by mimicking the tetrahedral intermediate of its substrate and essentially becoming "stuck," disabling the enzyme. However, due to the high mutation rates of retroviruses, and considering that a single nucleotide change within HIV PR can render it invisible to an inhibitor, the active site of this enzyme can change rapidly when under the selective pressure of replication-inhibiting drugs. One approach to minimizing the development of drug-resistance in HIV is to administer a drug cocktail comprised of drugs which inhibit several key aspects of HIV's replication cycle simultaneously, rather than one drug at a time. Other drug therapy targets include reverse transcriptase, virus attachment, membrane fusion, genetic integration and virion assembly.

Gallium and Uranium Join Forces

Sr.Jemini
II UG

The discovery of the first ever uranium-gallium bond may not have everyone jumping, it has several chemists looking to clean up nuclear waste in a frenzy! Don't get the connection yet? The discovery of this bond uranium-gallium bond has shed light on how related carbene ligands selectively extract uranium from lanthanides!



While X-Ray crystal structure data indicates that the bond doesn't rely on support from a bridging hydrogen atom, computational modeling experiments were used to make sure due to difficulty in locating these atoms.

Functional theory approach showed that not only was there no supporting hydrogen, but that the bond contained both sigma -and pi- character. This is the first observation of pi-bonding between low-valence group 13 metals and f-elements.

It must be noted that there is an astronomical distance between this observation and a practical use for the uranium-gallium complex. However, the gallium-containing ligand that was grafted to uranium has an electronic and orbital structure analogous to carbene ligands, whose uranium-binding properties have a more practical application: extracting elements from nuclear waste to ease processing.

Carbene ligands can selectively extract uranium from mixtures of lanthanides, but are unstable in aqueous environments, limiting their use in practice. Researchers speculate that the selectivity of carbenes for uranium over lanthanides could originate from pi-bonding much like that seen in the gallium complex - though no pi-bonding has been spotted in carbene complexes of uranium (IV) yet.

In The News

Sensitive Nanowire Disease Detectors Made by Yale Scientists

Scientists at Yale have created nanowire sensors coupled with simple microprocessor electronics that are both sensitive & specific enough to be used for point-of-care (POC) disease detection. The sensors use activation of immune cells by high specific antigen signatures of bacteria, viruses or cancer cells as the detector. When T cells are activated, they produce acid and generate a tiny current in nanowire electronics, signalling the presence of specific antigen. The system can detect as few as 200 activated cells. The nanowires can identify activation from a single specific antigen even when there is substantial background "noise" from a general immune stimulation of other cells. This level of sensitivity & specificity is unprecedented in a system that uses no dyes or radioactivity. Beyond its sensitivity, they say, the beauty of this detection system is in its speed producing results in seconds & its compatibility with existing CMOS electronics.

Nanodiamond Drug Device Could Transform Cancer Treatment

A promising nanomaterial-based biomedical device that could be used to deliver chemotherapy drugs locally to sites where cancerous tumours have been surgically removed has been developed. The flexible microfilm device has the potential to transform conventional treatment, strategies & reduce patients' unnecessary exposure to toxic drugs. The device takes advantage of nanodiamonds, an emergent technology for sustained drug release.

Millions of tiny drug-carrying nanodiamonds are embedded in the FDA-approved polymer parylene. Currently used as a coating for implants, the biostable parylene is a flexible and versatile material resembling plastic wraps.

A substantial amount of drug can be loaded onto high-surface clusters of nanodiamonds which are then put between extremely thin films of parylene, resulting in a device that is minimally invasive. The drug slowly and consistently releases from the embedded nanodiamond clusters for prolonged periods and also avoided the "burst" or massive initial release of the drug, a common disadvantage with conventional therapy.

Revolutionary Plastics: Acrylic Glass Made of Sugar!

Neethu S. Thottammariyil
III UG*

The world of plastics could well be heading into a candy shop. With the help of a newly discovered enzyme, 2-hydroxyisobutyryl-CoA mutase, scientists have synthesized environmentally friendly acrylic glass made of sugar.

The enzyme makes it possible to turn a linear C4 carbon structure into a branched one. Compounds of this type are precursors of Methyl Methacrylate (MMA). Parent compounds may of course include intermediate products from the petrochemical industry. The revolutionary aspect, however, is that this enzyme, integrated into metabolically appropriate microorganisms, can also transform sugars and other natural compounds into the products desired. Until now, the only way to produce 2-hydroxyisobutyrate (2-HIBA) – was a purely chemical process based on petrochemical raw materials.

The chemicals industry worldwide is searching for suitable biological processes, so that in future, renewable raw materials can also be used as a basis for MMA synthesis. The mutase presented here provides the solution: an enzyme which shifts a functional group from one position to another within a molecule.

Names for this plastic include "O-Glas" (for "organic glass") or "Piacryl". The plastic is fragile, but very UV-resistant and thus weatherproof. Its high translucency and low weight mean that acrylic glass has to some extent replaced traditional glass. Acrylic glass was used for the roof of the Olympic stadium in Munich as far back as 1970. Experts predict that the demand for acrylic glass will grow even more in future – for example, for photovoltaic units

A Day With An Eminent Woman Scientist

The 45th Annual convention of Chemists and International Conference on Recent Advances in Chemistry was organized by the Indian chemical Society, Kolkata and hosted by the post graduate department of studies in Chemistry, Karnataka University, Dharwad, from 23rd to 27th Nov 2008.

Three of us from the department, (Dr. Geetha Swaminathan, Dr. Gowri Sridhar and Ms. Mary George) attended and presented papers at the conference. The conference was inaugurated by Dr. Anthony P. Davis, School of Chemistry, University of Bristol, UK. He spoke on Synthetic lectins: Receptors for carbohydrates in aqueous solution. This conference gave us an occasion to interact with scientists from all over India and from countries like USA, UK and France.

One such interaction was with an enthusiastic, eminent scientist Dr. H. Ila, former Professor, Dept. of Chemistry, IIT Kanpur and currently working for Jubilant Biosys Ltd, Bangalore. She is the awardee of the professor J.C. Ghosh Memorial Lecture. Her lecture was on Polarised ketene dithioacetals and N, S-acetals: Versatile building blocks for heterocycle synthesis.

We were keen on interviewing this eminent scientist.

What could be the secret behind her success in research? Active support from her family – Her husband Dr. Junjappa, is also a professor of chemistry, IIT Kanpur – Research is Dr. Ila's priority and she believes that if pursued with focus and determination, one can be successful.

Why is the number of women scientists in the country so few? She feels that most women tend to give priority to their families. Women should strike a balance between family and work commitments. Driving force and exemplary time management are what is needed. Spending more time in the laboratory and library will enhance quality in research - A message to be imbibed by all young researchers.

Was being a woman a hurdle to her growth? Her prompt answer is No, not at all. Being a successful scientist is not based on gender, only on attitude.

Sleep Helps Learn, Retain, Remember

Sr. Maria Sudha & Sr. Linu Lukose
III UG



From time immemorial it has been known that sleep has several benefits. Fresh research shows that sleep helps the mind learn complicated tasks and helps people recover learning they thought they had forgotten over the course of a day.

Researchers at the University of Chicago used a test that involved learning to play video games to elucidate this point. They showed for the first time that people who had "forgotten" how to perform a complex task 12 hours after training found that those abilities were restored after a night's sleep.

"Sleep consolidated learning by restoring what was lost over the course of a day following training and by protecting what was learned against subsequent loss," said Howard Nusbaum, Professor of Psychology at the University of Chicago, and a researcher in the study. "These findings suggest that sleep has an important role in learning generalized skills in stabilizing and protecting memory."

The results may help in learning language processes such as reading and writing as well as eye-hand skills such as tennis.

200 college students, most of whom were women, who had little previous experience playing video games, were tested. The team reported the findings in the paper, "Consolidation of Sensorimotor Learning during Sleep," in the current issue of *Learning and Memory*. The team had students learn video games containing a rich, multisensory virtual environment in which players must use both hands to deal with continually changing visual and auditory signals. The first-person navigation games require learning maps of different environments.

For the study, researchers used first-person shooter games, with the goal of killing enemy bots (software avatars that play against the participant) while avoiding being killed.

The subjects were given a pre-test to determine their initial performance level on the games. Then they were trained to play the games and later tested on their performance. One group

was trained in the morning and then tested 12 hours later after being awake for that time. A second group was trained in the morning and then tested the next day, 24 hours after being trained. Another group was trained in the evening, and then tested 12 hours after a night's sleep and a fourth group was trained in the evening and then also tested 24 hours after training.

When trained in the morning subjects showed an 8 percentage point improvement in accuracy immediately after training. However after 12 waking hours following training, subjects lost half of that improvement when tested in the evening. When subjects were tested the next morning 24 hours after training, they showed a 10 percentage point improvement over their pre-test performance.

"The students probably tested more poorly in the afternoon because following training, some of their waking experiences interfered with training. Those distractions went away when they slept and the brain was able to do its work," Nusbaum said.

Among the students who received evening training, scores improved by about 7 percentage points, and went to 10 percentage points the next morning and remained at that level throughout the day.

The study follows Fenn, Nusbaum and Margoliash's earlier work, published in *Nature*, which showed for the first time that sleep consolidates perceptual learning of synthetic speech.

"In that study we showed that if after learning, by the end of the day, people 'forgot' some of what was learned, a night's sleep restored this memory loss," Nusbaum said. "Furthermore a night's sleep protected memory against loss over the course of the next day."

The latest study expanded that work to show that sleep benefits people learning complicated tasks as well. So do not compromise on your forty winks; they are essential for the multi-tasking and learning that have become part and parcel of student life in the twenty-first century.

The Chemistry of Firework Colours

Roshni Ramachandran
II UG

There are two main mechanisms of colour production in fireworks, incandescence and luminescence.

Incandescence: Incandescence is light produced from heat. Heat causes a substance to become hot and glow, initially emitting infrared, then red, orange, yellow, and white light as it becomes increasingly hotter. When the temperature of a firework is controlled, the glow of components, such as charcoal, can be manipulated to be the desired color (temperature) at the proper time. Metals, such as aluminum, magnesium, and titanium, burn very brightly and are useful for increasing the temperature of the firework.

Luminescence: Luminescence is light produced using energy sources other than heat. Sometimes luminescence is called 'cold light', because it can occur at room temperature and cooler temperatures. To produce luminescence, energy is absorbed by an electron of an atom or molecule, causing it to become excited, but unstable. When the electron returns to a lower energy state the energy is released in the form of a photon (light). The energy of the photon determines its wavelength or color.

Sometimes the salts needed to produce the desired color are unstable. Barium chloride (green) is unstable at room temperatures, so barium must be combined with a more stable compound (e.g., chlorinated rubber). In this case, the chlorine is released in the heat of the burning of the pyrotechnic composition, to then form barium chloride and produce the green color. Copper chloride (blue), on the other hand, is unstable at high temperatures, so the firework cannot get too hot, yet must be bright enough to be seen.

Pure colours require pure ingredients. Even trace amounts of sodium impurities (yellow-orange) are sufficient to overpower or alter other colors. Careful formulation is required so that too much smoke or residue doesn't mask the color.

Color	Compound
Red	strontium salts, lithium salts lithium carbonate, Li_2CO_3 = red strontium carbonate, SrCO_3 = bright red
Orange	calcium salts calcium chloride, CaCl_2 calcium sulfate, $\text{CaSO}_4 \cdot x\text{H}_2\text{O}$, where $x = 0, 2, 3, 5$
Gold	incandescence of iron (with carbon), charcoal, or lampblack
Yellow	sodium compounds sodium nitrate, NaNO_3 cryolite, Na_3AlF_6
Electric White	white-hot metal, such as magnesium or aluminum barium oxide, BaO
Green	barium compounds + chlorine producer barium chloride, BaCl^+ = bright green
Blue	copper compounds + chlorine producer copper acetoarsenite (Paris Green), $\text{Cu}_3\text{As}_2\text{O}_3\text{Cu}(\text{C}_2\text{H}_3\text{O}_2)_2$ = blue copper (I) chloride, CuCl = turquoise blue
Purple	mixture of strontium (red) and copper (blue) compounds
Silver	burning aluminum, titanium, or magnesium powder or flakes

What Materials Glow Under a Black or Ultraviolet Light?

Joicy Anjalin

III UG

There are a lot of everyday materials that fluoresce, or glow, when placed under a black light. A black light gives off highly energetic ultraviolet light. You can't see this part of the spectrum, which is how 'black lights' got their name. Fluorescent substances absorb the ultraviolet light and then re-emit it almost instantaneously. Some energy gets lost in the process, so the emitted light has a longer wavelength than the absorbed radiation, which makes this light visible and causes the material to appear to 'glow'.

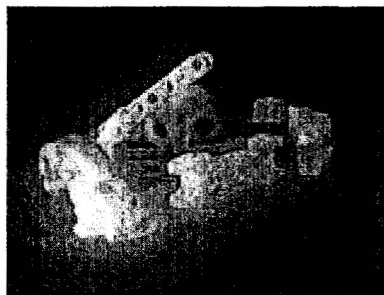
Fluorescent molecules tend to have rigid structures and delocalized electrons. Examples of common materials that contain fluorescent molecules include:

White paper is treated with fluorescent compounds to help it appear brighter and therefore whiter. Sometimes forgery of historical documents can be detected by placing them under a black light to see whether or not they fluoresce. White paper made post-1950 contains fluorescent chemicals while older paper doesn't.

Club Soda or Tonic Water The bitter flavoring of tonic water is due to the presence of quinine, which glows blue-white when placed under a black light.

Tooth Whiteners Whiteners and some enamels contain compounds that glow blue to keep teeth from appearing yellow.

Postage Stamps Stamps are printed with inks that contain fluorescent dyes.



Two Catalysts Are Better Than One

Menaka & Ashwini
III UG

Researchers have cracked a long standing problem in chemical synthesis - the catalytic alpha-alkylation of aldehydes - by combining two catalysts in one pot. The reaction is the first to combine a transition metal catalyst with an organocatalyst, and offers a simple route to compounds that have previously been out of reach, the researchers say.

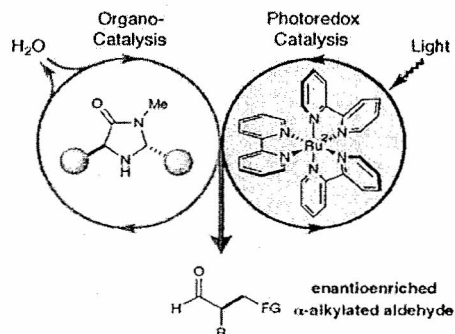
The reaction relies on the interplay between both catalysts to generate two reactive compounds - an activated aldehyde and alkyl radical - that combine to form the product. Coupling aldehydes to a range of reaction partners, while controlling the product stereochemistry to give a single enantiomer is a long standing aim of synthetic chemists - but had proven elusive. The new reaction gives good conversion rates, but most importantly, gives complete stereochemical control of product.

The organocatalyst has been used previously by to activate aldehydes. But, despite activation, the aldehyde would only react with a narrow range of highly reactive partners. Adding the inorganic catalyst - a photoactive ruthenium complex - solved this problem, generating a highly reactive alkyl radical in situ that readily attacked the activated aldehyde.

The photoactive inorganic ruthenium catalyst that the researchers chose is commonly used to mimic the processes of photosynthesis and operates through a single electron transfer process. However, whereas the light-activated catalysts typically used in synthesis require a powerful UV lamp, a standard light bulb was enough to activate the ruthenium catalyst, which could both pull apart the carbon-halogen bond to form the radical species and reduce the reaction intermediate to generate the desired product.

This makes the process instantly accessible to any synthetic chemist.

This is clearly a reaction of great promise for natural product synthesis and the production of pharmaceuticals.



ACCOLADES

- ❖ **Poornima Rangadurai** of II B.Sc Chemistry has been nominated by the DST (Department of Science & Technology) to attend the 59th Nobel Laureates Conference in Lindau, Germany from the 29th of June, 2009 – 11th July, 2009.
- ❖ **Gayatri S. Nair** of III B.Sc. Chemistry has successfully completed her second year under the Project Oriented Chemical Education (P.O.C.E.) Program run by Jawaharlal Nehru Institute of Advanced Scientific Research, Bangalore. She has completed a project on the ab initio properties of Heavy Metal Porphyrins.

SOLUTION OF THE CROSS WORD

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Paper Presentations of the Faculty and Students

AEC(OP)-18: Spectrophotometric Determination of Hydrazine

Mary George^a and K S. Nagaraja^b, ^aDepartment of Chemistry, Stella Maris College, Chennai 600 086,
^bDepartment of Chemistry, Loyola Institute of Frontier Energy (LIFE)

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Hydrazine is determined spectrophotometrically by forming the derivative 2,4-dinitrophenylhydrazine from 2,4-dinitrochlorobenzene. The formed dinitro derivative undergoes condensation reaction to form the hydrazone with p-dimethylaminobenzaldehyde (p-DAB). The resulting yellow colored product is stable in acidic medium and has a maximum absorption at 458 nm. The colour system obeys Beer's law in the range 0-7 g of hydrazine in an overall volume of 25 mL. The molar absorptivity is calculated to be $8.1 \times 10^4 \text{ L mol}^{-1} \text{ cm}^{-1}$ with a correlation coefficient of 0.998. The relative standard deviation is 1.7 % (n=10) at 6 g of hydrazine. Interferences due to foreign ions have been studied and the method has been applied for the determination of hydrazine in boiler feed water.

ORG(OP)-41 AN EFFICIENT ENTRY TO THE SYNTHESIS OF DISPIROHETEROCYCLES

Dr (Mrs) Gowri sridhar & Miss Jayanthi,

Dept of Chemistry, Stella Maris College, Chennai-600 086

This Work describes an efficient entry to dispiro pyrrolidine derivatives. Spiro compounds represent an important class of naturally occurring substances characterized by highly pronounced biological properties¹. Of particular interest, spiro-pyrrolidine with spiro-oxindole ring system are pharmacologically important compound and are found to be present in a number of alkaloids like horsfiline, spirotryprostatin A and B, (+)elacomine etc Many methods have been developed for the synthesis of spiro-pyrrolidine-oxindoles of which the following are some of the ways. They are Oxidative Rerangement Reactions, Intermolecular Mannich Reactions, Intermolecular Heck Reactions, Radical Cyclization Reactions, Asymmetric Nitroolefination & 1,3-Dipolar Cycloaddition Reactions. Of these methods, 1,3-Dipolar Cycloaddition Reaction is considered to be tentatively the best way for the synthesis of spiro-pyrrolidine ring.⁴ This take place in single step and the yield is high. The reactions are highly regio and stereoselective in nature. Here in we wish to promote the synthesis of spiroheterocycle by 1,3-Dipolar cycloaddition(1,3DC). Microwave induced organic reaction enhancement (MORE) chemistry has emerged as an important non-conventional method of reaction activation. It is one of the simple, fast, safe, eco-friendly and efficient methods of synthesis⁵⁻⁷. So the present study is an attempt to synthesis new dispiro-pyrrolidines by the 1,3DC reaction of azomethine ylides (1,3-dipoles) generated insitu by the decarboxylation of isatin and sarcosine with benzylidene-2-phenyl oxazol-5-one dipolarophiles in the Microwave oven. The dispiro heterocyclic nature of pyrrolidine derivatives(SCHEME) were confirmed by ¹HNMR, ¹³CNMR, DEPT, IR.

ORG(OP)-42 GREEN AND RAPID ACCESS TO THE SYNTHESIS OF DISPIRO PYRROLIZIDINES

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This work describes a convenient procedure for the straightforward preparation of polyfunctionalized pyrrolizidine systems. Pyrrolizidine alkaloids occur in many natural products of potential use in medicine and agriculture. In view of their potent and various biological activities, pyrrolizidine alkaloids as well as structurally related unnatural compounds are continuously stimulating new synthetic approaches.

Microwave irradiation is well known to promote the synthesis of a variety of organic compounds, where chemical reactions are accelerated because of selective absorption of microwave by polar molecules. As a part of our programme towards the non traditional approach to the experimental set up of organic reactions, the concept of "Microwave induced Organic Reaction Enhancement" (MORE) chemistry has been utilized for rapid, sustainable and efficient synthesis. Microwave assisted organic synthesis has attracted attention in recent years due to enhanced reaction rates, high yields, improved purity, ease of work up after the reaction and eco-friendly reaction conditions compared to the conventional methods. High regioselective nature of this type of methodology would be of potential interest in the construction of various alkaloids.

1, 3-Dipolar cycloaddition employing azomethine ylide is an important process in organic synthesis, acquiring a prominent place of synthetic strategy for a variety of targets, including natural products such as azasugars and alkaloids. Pyrrolizidine alkaloids occur in many natural products of potential use in medicine and agriculture. In view of their potent and various biological activities, pyrrolizidine alkaloids as well as structurally related unnatural compounds are continuously stimulating new synthetic approaches. The application of microwaves in promoting organic reactions has received intense attention recently. Inspired by the immense potential of rate acceleration of organic reactions by applying MW technology, herein, we wish to report a highly efficient MW promoted

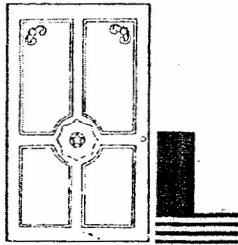
1, 3-DC reaction of azomethine ylide to oxazolones. The dispiro heterocyclic nature of pyrrolizidine derivatives were confirmed by ¹HNMR, ¹³CNMR, DEPT, IR. We have considered worthwhile to investigate the reaction of dipolarophile 4-arylidine-2-phenyloxazol-5-ones (scheme) with azomethine ylide generated from cyclic secondary amino acid, proline and 1,2-dione, isatin. In this pursuit we have prompted to study the reactivity of azomethine ylide with the dipolarophile by introducing the various substituents in the arylidene moiety of the dipolarophile. This method was carried out in the MW assisted manner under solvent free condition and in the presence of solid support like k-10 montmorillonite clay in a one pot process. The azomethine ylide was generated insitu by decarboxylative condensation of isatin with proline. This cycloaddition afforded cycloadduct in excellent yield with high regio and stereo selectivity and also of sufficient purity. The cycloaddition was found to proceed smoothly resulting in the formation of 1:1 adducts in good chemical yield, in all cases except 4-arylidine-2-phenyloxazol-5-ones containing p-N(Me)₂ and p-NO₂ substituent where the cycloaddition failed. The cycloaddition reaction afforded a series of novel dispiro pyrrolizidine derivative.

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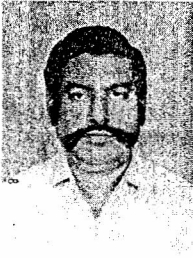
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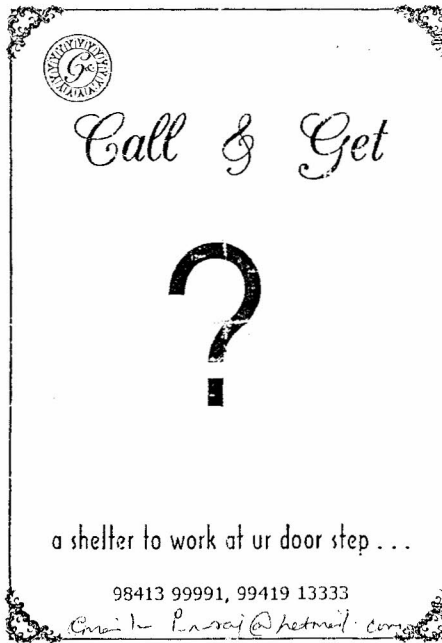
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Faculty with the eminent scientist H. Ila

Dr. Joseph Thomas

Chairman Technical Committee IIT Madras,
Chairman Research Advisory Committee for
Biotechnology IIT Madras
Chairman of Research Council of Rajiv Gandhi Center
for Biotechnology, Thiruvananthapuram. In 1991 Dr. Thomas
received FICCI Award for Excellence in Research in Life
Science from the Prime Minister.



These three common monolignols -- p-coumaryl alcohol, coniferyl alcohol, and sinapyl alcohol -- polymerize to make the lignin in Christmas tree wood.



Candles contains paraffin molecules, mixed hydrocarbon chains of C_nH_{2n+2} , shown here with chains of $n=24$, which is typical for candles.



The active ingredient of nutmeg is myristicin, or 5-Allyl-1-methoxy-2,3-(methylenedioxy)benzene. Some say myristicin has hallucinogenic properties



Turkey contains high levels of tryptophan, (S)-2-amino-3-(1H-indol-3-yl)propanoic acid, which allegedly causes drowsiness when eaten. One of the molecules shown will not make you drowsy because it is D-tryptophan, while your body can only metabolize its chiral opposite, L-tryptophan.



Gingerbread contains the molecule Zingerone; this gingerbread man includes four zingerone molecules. (Xmas version above).